

## COMPLICATIONS FOLLOWING GASTRO-ENTER-OSTOMY.

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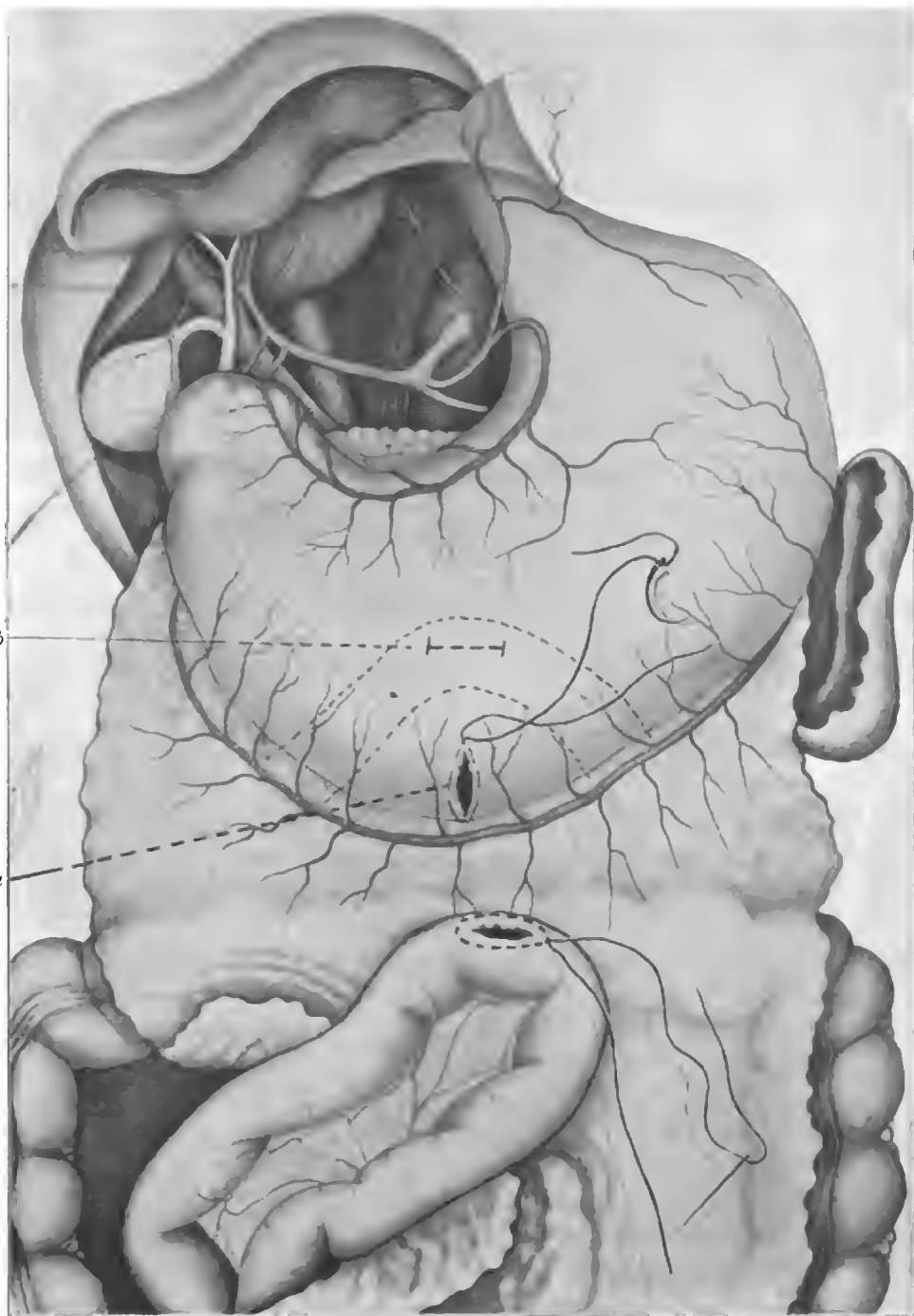
IN St. Mary's Hospital, of Rochester, Minnesota, during the past ten years, ninety-eight gastro-enterostomies have been performed by my brother, Dr. Charles H. Mayo, or myself, with nine deaths, the mortality in the malignant cases being 20 per cent. and in the benign series, 6 per cent. During this time fourteen pylorectomies and partial gastrectomies have been made with two deaths, 14 per cent. Of these nine were excisions with complete closure of both the stomach and duodenal ends, communication being established by means of an independent gastrojejunostomy of the usual type. Of these one died.

For the purpose of this study these nine cases are added to the ninety-eight cases above mentioned, giving one hundred and seven gastro-enterostomies with ten deaths, an average mortality of 9 per cent. The cause of death was as follows: Exhaustion, three cases; an exhaustion in which pernicious vomiting was a prominent feature, two cases; progressive pneumonia, three cases; detachment of the anastomosed intestine from the stomach wall, two cases. The deaths from exhaustion were due to the extreme starvation which existed at the time of the operation. The patients would appear fairly well until the fourth to seventh day, when a gradual failure of the vital forces would appear and death ensue in the course of from twelve to twenty-four hours, the post-mortem showing the abdominal condition to be good. Cachectic subjects bear rectal feeding badly, and early giving of nourishment by the stomach should be practised when possible.

The two cases in which regurgitant vomiting hastened the fatal ending were among the early operations, in which the intestine was joined to the anterior wall of the stomach, half-way between the greater and lesser curvatures, causing an intragastric pouch to form which contributed to the unfortunate complication. In neither one could it be said that the vomiting itself caused death, but in the feeble condition of the patients it certainly was a factor. It will be noted that nearly one-third of the total death-rate was due to bronchopneumonia.

There have been many explanations as to the frequency of lung complications following operations upon the stomach. It was thought to occur as a result of general anæsthesia, but experience has shown that it is relatively as frequent after the use of a local anæsthetic. The situation of the incision in the epigastrium, preventing coughing and expectoration, is thought to be an element in causation, yet similar incisions in the gall-bladder region have no such effect. The latest theory is that some of the venous blood returning from the stomach does not pass through the portal vein, and in this way infected emboli are carried directly into the circulation and pass at once to the lungs. In two of the three cases a chronic bronchial cough was present at the time of operation, and the patients were in bad general condition. In one case material was aspirated through the trachea from the œsophagus, causing an aspiration pneumonia. It is difficult, by means of the stomach-tube, to thoroughly cleanse and empty the greatly dilated stomach in debilitated subjects. In this case, on elevating the stomach out of the abdominal incision, some of the fluid contents gravitated into the œsophagus. This should be avoided in these cases by elevation of the head and thorax at this time. The recumbent posture has also an evil influence on some cases, and we now encourage the old and feeble to sit up early. It is evident that there is as yet no entirely adequate explanation for the production of the pulmonary complication. There are probably several contributing causes in most cases.

In the two cases in which the anastomosed intestine was detached, causing death from leakage, one took place on the



Showing proper and improper locations of opening. *a*, Proper position, leaving no pouch ;  
*b*, usual position, forming intragastric pouch.

seventh day after gastro-enterostomy for malignant pyloric obstruction. There was a small amount of free fluid present in the abdomen at the time of operation which would usually contraindicate a plastic procedure such as gastro-enterostomy. In the second case, detachment on the ninth day followed an epileptic seizure. This was in a patient with benign obstruction, who had up to that time done unusually well. He had suffered from epilepsy for years, and the aura began in the epigastric region. In a violent contraction of the stomach such a detachment might easily take place. Chlumsky's experiments on presumably healthy animals went to show that after five days the union was perfect. That this is not true as to diseased states in the human subject is shown by these two cases.

Of the ninety-seven cases which recovered from the operation, five benign cases came to secondary operation on account of changes at the anastomotic orifice.

The most important feature in the mechanics of the anastomosis is that the union shall be at the inferior border of the stomach, close to the greater curvature and at the bottom of the stomach pouch, giving a funnel shape. Properly placed, the anastomotic opening should have its inferior border at the bottom of the stomach, and as to whether the opening shall extend from this point upward anteriorly or posteriorly is really of little moment—see plate (Fig. 1). The anterior operation has usually been placed relatively higher than the posterior to avoid the blood-vessels, causing an intragastric pouch to form, which has been one source of pernicious vomiting. The posterior operation for technical reasons (easier exposure) is usually placed nearer the greater curvature. The union in the one hundred and seven cases under discussion was made to the anterior wall of the stomach eighty-three times and twenty-four times to the posterior wall, with equally good results, so that location of the opening on the anterior or posterior wall cannot of itself be essential.

In the experience of the writer, the one operation is as easy as the other. For thin subjects with a long mesocolon we prefer the posterior method. If the mesentery is short or

contains much fat, or if the vascular loop, from the superior mesenteric artery, which supplies the transverse colon, is small, bringing the opening in the posterior layer of the gastrocolic omentum in close proximity to it, the anterior operation is preferred. After posterior gastro-enterostomy the torn edges of the mesentery are sutured to the posterior wall of the stomach as advised by Willy Meyer, to prevent downward displacement and interference with the loop as happened to Meyer, Czerny, Körte, and others. These sutures are introduced in such a manner as to provide a short flap of the mesenteric margin, which drops over the anastomotic opening, furnishing further protection. After the anterior operation, the edges of the omentum are caught each side of the anastomosis and sutured to each other and to the stomach wall one inch above the opening. The edges are united to each other downward for three inches, forming an apron over the anastomosis, yet having no connection with it; and as this is done with a fine catgut suture, the adhesion is not of itself permanent. This makes the omentum available if leakage occurs, and in time the omentum returns to its normal situation if no accident happens, as I have had an opportunity to verify later.

This may seem an unnecessary precaution, but when it is considered that 20 per cent. of the deaths were due to separation of the bowel from the stomach at a time (ninth and tenth day) when neither suture nor button would furnish adequate support, it is not unreasonable. Both of the fatal cases were anterior operations, and it was the superior edge of the union which gave way as shown by post-mortem. The inferior margin, being protected by the origin of the omentum, was exceedingly firm. We have used the Murphy button in all of our cases, excepting one case in which the suture and the Robson bone bobbin were employed to meet a special indication.

CASE I.—*Gastro-enterostomy; Reoperation Four Years later for Secondary Ulceration; Recovery.*—Mrs. H. H. O., aged thirty-eight years, Scandinavian, mother of three children, housewife, was admitted to St. Mary's Hospital, May, 1899, with the following history: Has had symptoms of ulceration of the stomach

for several years; for the past two years the trouble has been constant. The vomiting, which at first was immediately after taking food, is now delayed a number of hours, and the larger part of the nourishment is eventually rejected. She eats as small an amount as possible, and is confined entirely to liquid food. Has lost thirty-five pounds or more in weight. Personal and family history good.

*Physical Examination.*—Emaciation marked, skin dry, pulse and temperature normal. Upper abdominal region distended. On inspection, peristaltic waves can be seen passing from left to right. Splashing phenomenon easily developed. On air distention, the greater curvature of the stomach found to lie on a line with the crest of the ilium. Test meal shows free acid. Diagnosis, benign pyloric obstruction due to the cicatrization of an ulcer.

*Operation.*—Irregular cicatrix involving pylorus, three-fourths of an inch in diameter and one and one-fourth inches in length. Anterior gastro-enterostomy. Recovery uneventful. For three years remained in splendid health, gaining over forty pounds in weight. April 1, 1902, readmitted on account of return of previous symptoms of obstruction, which had begun suddenly three months before, and were supposed to be due to an attack of appendicitis. Patient had lost much flesh and was on a liquid diet. The trouble was evidently due to some interference with the outlet of the stomach.

*Operation, April 2, 1902.*—A mass of adhesions was encountered to the right of the median line, due to an ulcer of the stomach just above the anastomotic orifice, and involving the opening above and upon the right side.

Perforation had occurred and the adhesion to the abdominal wall had prevented leakage. The transverse colon was closely adherent and much reduced in calibre where it passed under the anastomosis. The entire ulcerated area was excised, leaving a large opening with only one-fourth of the gastro-intestinal union on the left side intact. This defect was sutured, and the gastro-enterostomy completed by suture over a Robson bone bobbin, the large plastic being protected by the omentum. The Murphy button was found in the stomach somewhat corroded but in fairly workable condition. Pylorus completely obstructed. The stomach was drawn down into a funnel at the site of the anastomosis,

and I am under the impression that at the time of the sudden symptoms the button became impacted and caused the ulceration. This is surmise, as it was found in the fundus of the stomach.

Each button should be carefully inspected before it is used. We have found on an average nearly 20 per cent. of buttons of imperfect workmanship and dangerous.

If the stomach wall is thick, the muscular and peritoneal coats should be incised before the suture is placed, and the suture should grasp only a small portion of these structures, otherwise the button may be held in position unduly long. In many cases in which the button passes, vomiting, with symptoms of obstruction, may appear in the second or third week while it is in transit. Gastric lavage and rectal feeding for a day or two cause these symptoms to subside.

The suture operation for gastro-enterostomy is undoubtedly just as good as the button, and, so far as can be judged, the results are about the same. Among the men of great experience, Kocher uses the suture and the posterior method, Czerny the button and the posterior, Mikulicz prefers the suture in benign cases and the button in malignant cases, and uses the anterior operation altogether. He finds that an entero-anastomosis is necessary in the suture operation to prevent pernicious vomiting, but does not find it necessary with the button, which tends to prevent angulation while *in situ*, and this is during the dangerous period. Robson's bone bobbin acts in a similar manner. Kelling found that with the suture a ring of mucous membrane projected into the stomach, diminishing the caliber of the opening. The opening is less perfect with the suture, and entero-anastomosis is more often necessary to prevent pernicious vomiting. These advantages in favor of the button are counterbalanced by its tendency to drop into the stomach and remain there (Case I). This usually does no harm, and in malignant disease, at least, does not counterbalance the advantage.

In our earlier experience with gastro-enterostomy, the operation was performed entirely for pyloric obstruction, and

in but two cases (IV and V) did any secondary complication develop with regard to the orifice, excepting its occasional occlusion by an advancing malignant growth. Two cases of malignant obstruction, examined post-mortem after the lapse of some months, showed no marked contraction of the opening. For non-malignant pyloric obstruction, cases in the best of health, all the way from the present time up to eight years after the operation, demonstrate the permanence of the artificial opening. In two benign cases dying of other causes, six months and three years respectively after the operation, and representing an anterior and posterior location of opening, there was no contraction. In a case reported by Cordier after six and one-half years, death from other cause allowed of post-mortem, and there was no contraction of the anastomotic opening found. Without going into detail, it may be said that if permanent obstruction at the pylorus exists, no marked contraction of a properly formed gastro-enterostomy may be feared, unless by accident (Case V).

About three years ago, gastro-enterostomy for the relief of ulcer was first performed at St. Mary's Hospital, and since that time with increasing frequency, about twenty-five cases in all. In a majority of these cases the pylorus was not mechanically obstructed, although the ulcer was usually in the pyloric region, and in some cases ultimate cicatrization might be expected to materially reduce the caliber of the normal opening. In three of these cases, angulation and obstruction at the site of the anastomosis occurred at a later date (Cases II, III, and IV). In these cases, secondary exploration revealed a marked contraction of the orifice, reducing its size to that of a lead-pencil or less, although in no case was obliteration complete. There was found an angulation of the jejunum at the attachment, causing a spur which accounted for the symptoms. The reduction, so far as the stomach was concerned, was of little moment, but a contraction involving one-third of the lumen of the small bowel was serious and caused valve formation.

CASE II.—*Entero-anastomosis Thirteen Months after Gastro-enterostomy; Recovery.*—Miss G. C., aged twenty-one years, American, seamstress, was admitted to St. Mary's Hospital, May 9, 1900, with a typical history of ulcer, which had existed for more than a year and defied ordinary methods of treatment. Hæmatemesis had been a prominent feature, and on two occasions so copious as to threaten life; had lost twenty-five pounds in weight. Family and personal history otherwise good.

*Physical Examination.*—Marked anæmia from the hæmorrhages, organs other than stomach normal. A painful point the size of a silver dollar in the epigastrium. Stomach contents not examined, it being feared that the necessary manipulation might cause a return of the hæmorrhage. May 10, anterior gastro-jejunostomy, Murphy button. Stomach small, pylorus unobstructed, ulceration on lesser curvature of irregular outline, an inch in diameter, shown by induration, and covered by perigastric adhesions. Button passed during third week. Discharged in the fourth week. Rapid gain in weight and complete disappearance of symptoms for four months. Then began to have attacks of burning pain in the stomach. These became more frequent, and occasionally a little bile-stained fluid would be vomited. This was not attended by great loss of weight or strength, but was very annoying.

In June, 1901, exploration revealed the fact that the gastrointestinal fistula had contracted to the size of a lead-pencil or smaller; this produced a kink of the jejunum at the site of the anastomosis. Entero-anastomosis between the afferent and efferent limbs of the jejunum promptly relieved the symptoms. Patient now in good health.

CASE III.—*Secondary Gastro-enterostomy and Entero-anastomosis Twenty Days after Primary Gastro-enterostomy; Recovery.*—P. D., aged thirty years, German, farmer, was admitted to St. Mary's Hospital, March 21, 1901. History of chronic ulcer of the stomach extending over six years, which had obstinately resisted treatment. During most of this time he had been incapacitated for labor. To relieve the pain, semi-starvation had been practised. Personal and family history immaterial.

*Physical Examination.*—An emaciated man of sallow complexion, dry and leathery skin. Heart, lungs, kidneys, etc., in normal condition. Tenderness just above umbilicus. Stomach

moderately dilated, free acid and some retardation of food. March 22, anterior gastro-jejunostomy, Murphy button. Ulcer on posterior wall and adherent to pancreas. The latter enlarged and thickened, no mechanical obstruction at the pylorus. For two weeks patient did very well, then began to vomit biliary and pancreatic secretions; button passed on sixteenth day. Vomiting at first intermittent, and no food returned unless given during the period of active regurgitation. Twenty days after the primary operation, the abdomen was reopened. The anastomotic opening had contracted to the size of a lead-pencil and spur formation of the small bowel was marked. As it seemed improbable that the ulcer should have permanently cicatrized in this short space of time, anterior gastrojejunostomy was again performed with the Murphy button, and an entero-anastomosis short circuiting the biliary and pancreatic secretions below both openings was made by means of a small button. Discharged in three weeks. Rapid gain in weight and strength. He is now in good health and able to perform manual labor.

Entero-anastomosis promptly relieved the condition in these two cases. In the third, for reasons referred to later, death ensued. Contraction of the anastomotic opening is to be expected if the pylorus is unobstructed; but that it does not always produce symptoms was shown in a fourth case, in which gastro-enterostomy for an active ulcer had promptly relieved a most serious condition. At a secondary operation for a pelvic tumor, some months later, great contraction of the orifice was found, but without unpleasant symptoms arising therefrom. The writer was under the impression, in Case V, after the first entero-anastomosis failed to relieve, that perhaps the kinking caused the bile to accumulate in the duodenum, and that the regurgitation was through the pylorus. For this reason the pylorus was excised with complete closure of both the duodenum and stomach ends; yet this failed to check the biliary vomiting, showing conclusively that it was the spur at the opening alone which was responsible for the trouble. Von Eiselberg reports cases in which he has closed the pylorus by a circular purse-string suture, evidently with the same idea which proved fallacious in this case.

The question of the reduction of the opening taking place in the greatly dilated stomach *pari passu* with the contraction of the stomach itself has been pretty well settled by Robson, Körte, and others. The stagnation is promptly relieved, but the hyperdilated stomach does not contract much, and the lesser degrees of dilatation which regain normal size do not materially affect the anastomotic opening. Carle and Fantino have shown conclusively that small quantities of bile are to be found in the stomach after gastro-enterostomy, and that it does not lead to trouble. Ferrier and others have connected the gall-bladder directly with the stomach without interfering with digestion. The pancreatic juice cannot be the cause, as Stendel has experimentally divided the jejunum, fastening the open end to the stomach and closing the duodenum completely at the severed point, causing all the biliary and pancreatic secretions to pass through the stomach, yet no harm resulted. This was also true of Moynahan's case in which this procedure was carried out on the human subject. McGraw believes that the views of Kelling are correct, and that it is the distention of the duodenum which is responsible for the evil effects. The fact remains that entero-anastomosis between the proximal and distal loops of the intestine, short circuiting these secretions, relieves the condition. The possibility of secondary spur formation following gastro-enterostomy for ulcer in which the pylorus is open must be borne in mind, and, if possible, excision of the ulcer is to be preferred. This the writer has been able to do three times for gastric ulcer and once for duodenal. It has been advocated, especially in this country by Robert Weir, to perform an entero-anastomosis in all cases of gastro-enterostomy at the primary operation. This is certainly logical in the cases under consideration in which the pylorus is open.

We have preferred the simple operation of entero-anastomosis rather than the more elaborate methods of Roux and others, and in only one case, that a posterior operation, has relief failed to follow. This was due to the fact that the jejunum was anastomosed so close to its origin as to prevent proper drainage from the proximal side through the interintestinal fistula.

CASE IV.—*Gastro-enterostomy followed by Entero-anastomosis, Pylorectomy, Entero-anastomosis; Roux's Operation; Death.*—Mrs. J. M., aged forty-two, one child, Scandinavian, housewife, was admitted to St. Mary's Hospital on June 19, 1901. Typical history of chronic ulcer of the stomach. For three years symptoms nearly constant, vomiting, pain, loss of weight and strength, confined to the bed for several weeks previous to admission to the hospital, and for some months has required opiates more or less constantly. Personal and family history good.

*Physical Examination.*—Emaciation marked. Painful area in epigastrium. Stomach not increased in size. Free acid. June 20, posterior gastrojejunostomy, Murphy button. Attachment to jejunum about six inches from its origin. Stomach not dilated, pylorus open, location of ulcer could not be accurately determined on account of perigastric adhesions. Gall-bladder contained one stone evidently slumbering, as there were no evidences of disease about this viscus. Stone removed and gall-bladder drained through stab wound on the right side. Patient discharged in good condition on the twentieth day. July 24, 1901, readmitted; one week before had commenced to have attacks of burning pain in the stomach, and since had regurgitated a little bile-stained fluid at frequent intervals. Gastric lavage failed to relieve the symptoms.

June 25, entero-anastomosis. Operation difficult and unsatisfactory on account of the short length of the afferent intestine, and when completed, the interintestinal fistula was on a level with the gastric opening and only about two inches from it. Gastro-enterostomy contracted to less than the tip of the little finger and angulation of the attached jejunum.

Condition improved rapidly and for a time was apparently relieved. October 12 readmitted, with all of the old symptoms in an aggravated form. Under the impression that the biliary and pancreatic secretions entered the stomach through the pylorus, on October 14 pylorectomy was performed, and the duodenum and stomach completely closed by a purse-string suture. No relief. October 18 a second button entero-anastomosis was made. This was a mistake, as between the previous entero-anastomosis and the origin of the jejunum there was less than three inches. Some relief was experienced for a few days. October 30 the previous symptoms had returned with increased sever-

ity, and as the patient was becoming exhausted, as a final resort the operation of Roux was performed. The adhesions from the previous operations rendered this extremely difficult. The jejunum was divided as closely as possible to the last entero-anastomosis and the distal end turned in by a purse-string suture. Less than an inch of jejunum projected on the proximal side. A Murphy button was inserted and with some difficulty secured in position. A loop of bowel sixteen inches below was attached laterally. Patient returned to bed in bad condition and died thirty-six hours later. A melancholy ending after such courage and endurance.

This at once brings up the question as to how long a loop of jejunum should be made above the point of anastomosis. Robson says that for the anterior method twelve inches is about right and for the posterior somewhat less. Mikulicz says that fifteen cubic centimetres is the necessary amount for the posterior operation and fifty cubic centimetres for the anterior operation. We have averaged about fourteen inches for the anterior method, and since the unfortunate termination of the case referred to, not less than ten inches for the posterior. Meyer reports a case in which fifteen centimetres proved to be too short for convenience at a secondary operation. Peterson, from the Heidelberg clinic, has studied the anatomy of gastro-enterostomy, and calls attention to the fact that the origin of the jejunum is at a higher level than the site of the anastomosis in the posterior operation. This would place the proximal portion of the jejunum above the opening, and he believes that the absence of pernicious vomiting in the cases in Czerny's clinic is due to this cause, although it is evident that the location of the opening on the posterior wall of the stomach must in these cases have been at an inferior point, and it is probable that the advantage may lie in this feature of the operation. If the obstruction at the pylorus be permanent, there can be no objection to the short length of jejunum above, but if an open pylorus threatens contraction and spur formation, this may prove unfortunate. The last complication to be briefly referred to is the possibility of the small bowel passing through the loop of intestine above

the anastomosis. This danger is much greater with the anterior than the posterior method. Case V so well illustrates this condition as to need no further comment.

CASE V.—*Anterior Gastro-enterostomy; Secondary Operation for the Relief of a Twist at the Anastomotic Opening caused by Small Intestine passing through the Loop.*—R. N. S., aged forty-one years, American, barber, was admitted to St. Mary's Hospital, January 1, 1901, with the following history. For several years has suffered from attacks of burning pain in the epigastric region lasting for a few minutes at a time, but recurring at intervals of several hours. Much worse when at work at his trade. These "cramps" would last in this way for several weeks at a time, after which there would be an interval of weeks or months of good health. For several months has had more or less stomach trouble, and occasionally vomited up the contents of the stomach. The distress has caused him to eat sparingly, and he has lost twenty-five pounds in weight. He had an attack of appendicitis with an abscess some years ago; the latter had been incised, but the appendix was not removed. He has had a right inguinal hernia for many years.

*Examination.*—A spare man, six feet and one inch in height, emaciation noticeable. With the exception of the stomach, no feature of interest. Painful point in epigastrium. Free acid, greater curvature of stomach three inches below the umbilicus.

*Diagnosis.*—Pyloric obstruction from ulcer. January 2, anterior gastrojejunostomy, Murphy button, appendectomy, and Bassini operation on hernia. An ulcer existed at the pylorus extending to the lesser curvature, irregular contour, size of last phalanx of forefinger. Evidently partially cicatrized and obstructing pylorus. Fourteenth day symptoms of intestinal obstruction lasting forty-eight hours. Condition relieved by gastric lavage and rectal feeding. Button passed on the sixteenth day, evidently cause of symptoms. Discharged January 18; gained rapidly in weight and strength. For a year remained in good health, although complained that if he stood erect he had a "drawing feeling" in his stomach. From this time to May 14, 1902, when he was readmitted to the hospital, he had slowly developed all of the former symptoms of obstruction at the outlet of the stomach, and had a constant pain in the abdomen centring below the umbilicus.

May 15 abdomen opened. Gastrojejunal orifice nearly obliterated and stretched to an inch in length. Jejunum twisted at the site of anastomosis one-half turn from the left to the right. Somewhat more than one-half of the small intestine had passed through the loop of jejunum between the origin of the jejunum and the attachment to the stomach. The point of entrance was on the right side beneath the transverse colon. The traction weight of the intestines upon the mesentery at the inferior margin of the loop had caused the volvulus. The mesentery at this point was much thickened. The intestines were replaced. The gastrojejunal fistula divided and the opening into the stomach closed. The opening into the jejunum was enclosed by a purse-string suture, and the half of a Murphy button was introduced and a posterior gastrojejunostomy made. The pyloric stricture was nearly complete, the ulcer evidently cicatrized. It is probable that the part of jejunum immediately below the anastomosis passed through the loop first, producing the twist which was so prominent a feature on opening the abdomen. As to when this happened, it is hard to tell, probably not for some months after the operation. When the process once began, it might be expected to continue until such an amount of intestine travelled over the loop as to pull the mesentery taut, the symptoms increasing as the condition gradually developed. It is possible that at the time the juncture was effected, a slight twist might have occurred.